COMPARATIVE STUDIES OF THE EFFECT OF *HELMINTHOSPORIUM MAYDIS* AND *CURVULARIA PALLESCENS* INFECTION ON TOTAL NITROGEN OF MAIZE LEAVES

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SUMMARY. – Maize leaves of cultivar Igbira, were artificially inoculated with spore suspensions of each *Helminthosporium maydis* Nisikado and Miyake and *Curvularia pallescens* Boedijn, to determine their effect on the total nitrogen content of the host leaf. There was a sharp rise in total nitrogen content of the leaves inoculated with *H. maydis* and *C. pallescens* after 12 and 24 hours of inoculation respectively, while it was gradual in the control leaves. Furthermore, *H. maydis* inoculated leaves significantly increased in total nitrogen content more than both the *C. pallescens* inoculated and the control leaves, throughout the study. The *C. pallescens* ones differed significantly from the control only at 36, 48, 96, 108, 120 and 132 hours after inoculation.

RÉSUMÉ. – Des feuilles de maïs de cultivar IGBIRA furent artificiellement inoculées avec des suspensions de spore de *Helminthosporium maydis* Nisikado et Miyake et de *Curvularia pallescens* Boedijn afin de déterminer leur effet sur la teneur en azote de l'hôte. Une forte augmentation de la teneur totale en azote des feuilles inoculées avec le *H. maydis* et le *C. pallescens* au bout de douze à vingt quatre heures respectivement après l'inoculation a été observée, tandis qu'elle était graduelle dans les feuilles témoins. Par ailleurs, la teneur totale en azote des feuilles inoculées avec le *H. maydis* a considérablement augmenté, davantage que celle des feuilles inoculées avec du *C. pallescens* et des feuilles témoins, tout au long de l'étude. Les feuilles inoculées avec le *C. pallescens* étaient sensiblement différentes des feuilles témoins, 36, 48, 96, 108, 120 et 132 heures après l'inoculation.

KEY WORDS : *Curvularia pallescens*, *Helminthosporium maydis*, Igbira.

INTRODUCTION

Helminthosporium maydis Nisikado and Miyake which has been the causal organism of maize leaf blight has been a major problem in various maize growing

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areas of the world (BOURIQUET, 1935; ALCORN & PONT, 1973; HANNI & al., 1973; FATIMA & al., 1974). *Curvularia pallescens* Boedijn on the other hand has been known within the last 25 years to Nigeria, and has assumed great importance in maize cultivation (MABADEJE, 1969).

Much has been known in respect of *H. maydis* and little about *C. pallescens* yet their effect on the total nitrogen of maize leaves has not been investigated hence this study. This study might help in the chemical monitoring of the plant growth substances or fertilization, in order to combat the growth of these parasites on maize plants towards reducing their infection capacity.

MATERIAL AND METHOD

The isolates of *H. maydis* and *C. pallescens* used for the study were obtained from the experimental plot of the National Cereals Research Institute Moor Plantation Ibadan, Nigeria. The isolates were maintained on potato dextrose agar (PDA) during the investigations.

Maize seedlings of cultivar Igbira were raised in 390 medium size plastic pots inside a green house. At the age of 21 days, the potted plants were divided into three sets and leaves of equal size were tagged with plastic labels on the seedlings and they were treated as follows :

Ten sites on each tagged leaf was inoculated with 0.05 ml of spore suspension containing 5.0×10^4 spores/ml of the suspension (made with distilled water) of *H. maydis*, the second sets were treated with spore suspension of *C. pallescens* of the same concentration as that of *H. maydis*. Distilled water was used for the third set which was the control. The spore suspension were allowed to air dry, and the plants were incubated at about 100 % relative humidity, and 27°C for about 24 hours. The set up consist of 5 replicates and enough plants to take samples at intervals of 12 hours for 13 days.

The total nitrogen level of the treated and control leaves samples was determined by Kjedahl's method as contained in the A.O.A.C. methods of analysis 1975 edition (ANON, 1975).

RESULTS

There was increase in the total nitrogen content on both the control as well as inoculated leaves. However, the total nitrogen seemed to be greater with *C. pallescens* and greatest with *H. maydis* inoculated leaves (Fig. 1). With *H. maydis*, the sharp increase started from 12 hours after inoculation and this became gradual after 72 hours of inoculation. It was a bit different with *C. pallescens* inoculated leaves in which sharp increase in total nitrogen was not observed until after 24 hours of inoculation. This eventually became gradual after 96

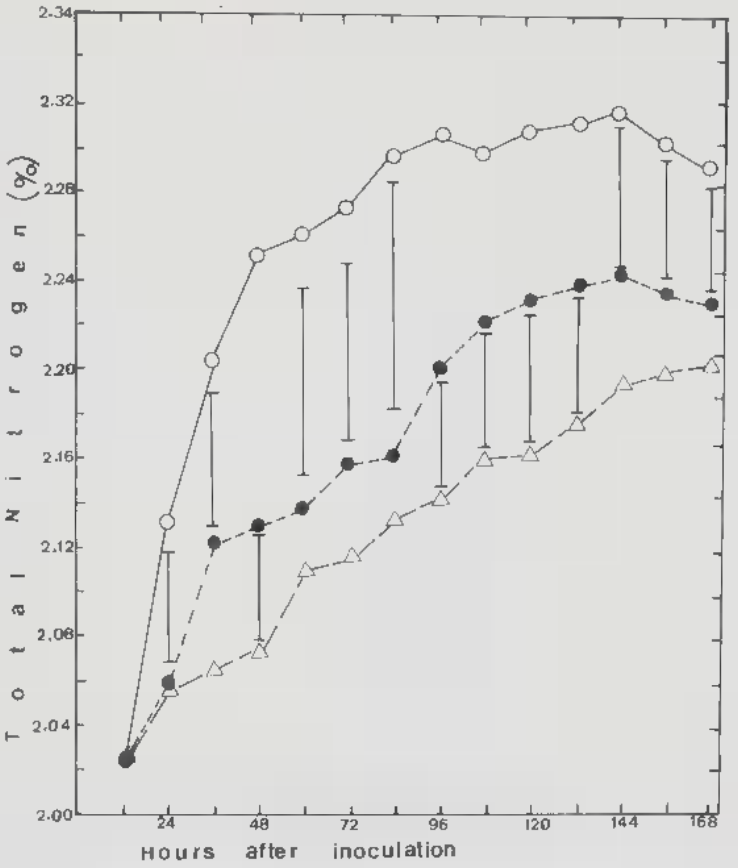

Fig. 1 — Variation in total nitrogen content (% of dry weight) of maize leaves inoculated with *Helminthosporium maydis* and *Curvularia pallescens* and the uninoculated ones. (o—o : *H. maydis* inoculated leaves; ■- - -● *C. pallescens* inoculated leaves; △— —△ : Uninoculated leaves (Control); ⌶: Least Significant Difference (LSD) at P = 0.05).

Fig. 1 — Variation du taux d'azote total (exprimé en % de poids sec) de feuilles de maïs inoculées par *Helminthosporium maydis* et *Curvularia pallescens* et de témoins. (o—o : feuilles inoculées par *H. maydis*; ●- - ■ : feuilles inoculées par *C. pallescens*; △— —△ : feuilles non-inoculées, témoins; ⌶: plus petite différence à 5 %).

hours of inoculation (Fig. 1). After 144 hours, there was a decline in the total nitrogen content of the inoculated leaves, while that of the control were still increasing but gradually.

Generally as from 24 hours of inoculation, the increase in *H. maydis* inoculated leaves was significantly greater than those of the *C. pallescens* and the control through out the study period (Fig. 1). *Curvularia pallescens* inoculated leaves was only significantly greater than the control at 36, 48, 96, 108, 120 and 132 hours after inoculation.

DISCUSSION

The nitrogen increase due to infection was in consonance with earlier work reported in which HRUSHOVETZ (1954) showed that the composition in amino acids is strongly modified in the roots of wheat plants infected by *Helminthosporium sativum*.

Analysis of the simple organic compounds of nitrogen in extracts of bean leaves from *Pseudomona phaseolicola* infected and uninfected plants indicated about twenty two and fifteen ninhydrin positive compounds respectively (WOOD, 1967). It could be possible that excessively high concentration of amino compounds arose from the action on host of proteolytic enzymes secreted by the pathogens (WOOD, 1967). The higher total nitrogen content recorded on *H. maydis* infected leaves might be due to the fact the wider area of the leaves was infected and the infection was greater with the fungus than the spot-like lesions of *C. pallescens* infected leaves.

Furthermore, it was observed that there was a sharp relative rise in the nitrogen content after 12 hours in *H. maydis* infected leaves while *C. pallescens* ones did not show any relative rise until after 24 hours of inoculation. This fact could be linked with the different period of entry of the pathogen into leaf tissue (Olufolaji personal communication). It has been observed that *H. maydis* penetrated and established in the leaf tissue earlier than *C. pallescens* hence, the earlier increase in total nitrogen of the former than latter.

The levelling up of the total nitrogen curve for the infected leaves after 96 hours might denote the period at which the fungi had reached the maximum disease causing process for the first cycle before secondary infection would start the next one. Furthermore, the relative decline afterwards could indicate the possibility of resistance put up by the host plants to decrease the infection activities of the fungi.

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REFERENCES

ALCORN J.L. and PONT W., 1973 – *Drechslera maydis* race - T in North Queensland Australia. *Austral. Pl. Pathol. Soc.*, Newsletter 9 : 19-20.

ANON, 1975 – *In* : Association of Official Analytical Chemistry (A.O.A.C.), Official Method of Analysis, 12th Edition. Washington D.C. 1975 : 264-272.

BOURIQUET G., 1935 – Phyto-pathological notes. *Inst. Bull. Pl. Protect.* 9 : 125-128.

FATIMA R., MARTIN S.B. and NEERGAARD F., 1974 – Importance of *Drechslera maydis (Helminthosporium maydis)* on seeds of crops other than maize. *Seed Sci. and Tech.* 2 : 271-383.

HANNI E., LANINI F. and HOSTETTLER K., 1973 – Erine nene Maisk rankeit in der schweveizerusacht durch *Helminthosporium maydis* resse - T - Schweveizerische Land Wirschaftliche Forschung 12 : 363-378 (Abstract seen in *Rev. Pl. Pathology* (1976) 55 : 35).

HRUSHOVETZ S.B., 1954 – The effect of infection by *Helminthosporium sativum* on the amino-acid content of wheat plants roots. *Canad. J. Bot.* 32 : 571-575.

MABADEJE S.A., 1969 – *Curvularia* leaf spot of maize. *Trans. Brit. Mycol. Soc.* 52 : 267-271.

WOOD R.K.S., 1967 – Physiological plant pathology. Oxford and Edinburgh, Blackwell : 209-211.